PITKEATHLY MIRES SPECIAL AREA OF CONSERVATION (SAC)

CONSERVATION ADVICE PACKAGE

Image: © NatureScot

Site details

Site name:	Pitkeathly Mires
Map:	https://sitelink.nature.scot/site/8346
Location:	Eastern Scotland
Site code:	UK0030239
Area (ha):	60.58
Date designated:	17 March 2005

Qualifying features

Qualifying feature	SCM assessed condition	SCM visit date	UK overall Conservation Status
Very wet mires often identified by an unstable 'quaking' surface (Transition mires and quaking bogs) [H7140]	Favourable Maintained	15 August 2003	Unfavourable - Bad
Slender green feather-moss (*Drepanocladus (Hamatocaulis) vernicosus*) [S1393]	Favourable Maintained	26 October 2008	Favourable

Notes:
Assessed condition refers to the condition of the SAC feature assessed at a site level as part of NatureScot's Site Condition Monitoring (SCM) programme.
Conservation status is the overall condition of the feature throughout its range within the UK as reported to the European Commission under Article 17 of the Habitats Directive in 2019.

- More up to date SCM results available for equivalent SSSI feature

Overlapping protected areas:

Pitkeathly Mires Site of Special Scientific Interest (SSSI)
Pitkeathly Mires SSSI

Key factors affecting the qualifying features

Very wet mires often identified by an unstable 'quaking' surface
This feature is also known as transition mires and quaking bogs. The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich.

Transition mires and quaking bogs can occur in a variety of situations, related to different geomorphological processes: in flood plain mires, valley bogs, basin mires and the lagg zone of raised bogs, and as regeneration surfaces within mires that have been cut-over for peat or areas of mineral soil influence within blanket bogs (e.g. ladder fens).

Pitkeathly Mires is situated in a shallow valley on the north side of the Ochil Hills, at a height of around 250m. The site was selected as an SSSI for its series of upland basin mires which contains extensive and undisturbed areas of nutrient-poor and intermediate fen and flush vegetation. The fens are waterlogged habitats fed by infiltrating water from the surrounding land, and dominated by sedges and mosses. The bed rock is basic in nature consisting of lavas mainly of basic non-feldsparphyric pyroxene-andesites but include some flows of basalt. The basic nature of the bedrock leads to base-rich ground water flushing into the basin mires which in turn has a profound effect on the vegetation.

Key factors affecting this habitat type are land management changes in the catchment which can additionally, affect the sites hydrology and water quality. In the case of Pitkeathly Mires, land management changes include new woodland creation and renewable energy developments. Undergrazing could be an issue for these mires should scrub start to invade, however scrub has not become an issue within the basins in the recent past.

Further information about very wet mires often identified by an unstable 'quaking' surface can be found here.

Slender green feather-moss

Slender green feather-moss (*Hamatocaulis vernicosus*) is a plant found in base-rich but not strongly calcareous flushes and springs in upland areas of Scotland and lowland sedge fens and mires. Although more frequent in the uplands, it does not reach very high altitudes.

Pitkeathly consists of a group of upland mires which form an undisturbed area of flushes, with poor- and intermediate fen. The site contains a small but healthy population of slender green feather-moss *Drepanocladus vernicosus* and is the most northerly Scottish representative.

Nationally, the main threats to this species are thought to be destruction of its habitat, lowering of the local water table at lowland sites, and heavy grazing and trampling of flushes by sheep and deer at upland sites. There is currently very little grazing by domestic stock on Pitkeathly Mires and this has been the situation for some time. Land management changes in the form of woodland creation with conifers can affect the catchment and water quality of the site if not planned carefully.

Further information about slender green feather-moss can be found here.

Conservation Priorities

There are no priority qualifying features within the site and no apparent management conflicts between the qualifying features. If any conservation management conflicts between the qualifying features were to arise consideration should first be given to, slender green feather-moss the primary reasons for site selection. However, the impact of any proposed management measure on all the qualifying features should first be considered as part of a Habitats Regulations Appraisal.

All qualifiers rely on good water quality, and appropriate water levels and hydrological functioning.

Conservation objectives for transition mires and quaking bogs (very wet mires often identified by an unstable 'quaking' surface)

1. To ensure that the qualifying feature of Pitkeathly Mires SAC is in favourable condition and make an appropriate contribution to achieving favourable conservation status.
Favourable Conservation Status (FCS) is considered at a European biogeographic level. When determining whether management measures may be required to ensure that the conservation objectives for this site are achieved, the focus should be on maintaining or restoring the contribution that this site makes to FCS. When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, band c). If broader information on the feature is available then it should be used to provide context to the site-based appraisal. Note that "appropriate" within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of Pitkeathly Mires SAC is maintained by meeting objectives 2a, 2b and 2c for the qualifying feature.
The aim at this SAC is to maintain the qualifying habitat in a favourable condition as a contribution to its wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on maintaining site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will continue to be maintained. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the maintenance of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover. This objective recognises that the qualifying habitat is exposed to a wide range of drivers of change. Some of these are natural and are not a direct result of human influences. Such changes in the habitats' extent, distribution or condition within the site which are brought

about by natural processes, directly or indirectly, are normally considered compatible with the site's conservation objectives. An exception to this is when the favourable condition of a habitat is dependent on halting or managing natural succession. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

2a. Maintain the extent and distribution of very wet mires often identified by an unstable 'quaking' surface within the site

The extent of transition mires and quaking bogs at Pitkeathly Mires SAC has been estimated as 3ha. This should be maintained.

Accurate measurement of the extent of the transition mires and quaking bogs habitat is hard to achieve due to gradual transitions in vegetation to adjacent habitats. The area figure has been taken from the Standard Data Form and is therefore used as a guide only. There should be no measurable net reduction in the extent of the habitat and its distribution throughout the site should be maintained. Habitat survey may be needed prior to assessing whether any plans or projects would alter the distribution and extent of the habitat.

This habitat is transitional with other adjacent wetland habitats so current baseline estimates may not be precise and any changes in extent estimates as a result of new survey may not represent real change but greater precision.

On Pitkeathly Mires this habitat is found in an upland situation.

2b. Maintain the structure, function and supporting processes of very wet mires often identified by an unstable 'quaking' surface

This habitat is usually present as a mosaic with other wetland habitats. The term "transition mire" relates to vegetation that, in floristic composition and general ecological characteristic, is transitional between acid bog and alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich.

The maintenance of appropriate hydrology and water quality for this habitat is essential in retaining the structure and function. Management to prevent or reduce detrimental effects of drainage and nutrient enrichment including in the wider surrounding area, is key. Pitkeathly mires are fed by spring water which is apparently of a high pH or base-rich. The water table appears to be high for the majority of the year.

Colonisation of this habitat by vigorous native species such as soft rush, water horsetail and reed canary grass , tree or scrub growth or invasive non-native species could led to irreversible habitat loss in the longer term, through shading, drying out of the habitat and possible conversion to other wetland types rich in nutrients, open-ground habitats or woodland.

Grazing, browsing and trampling by sheep and/or deer and/or recreation can damage the structure of this habitat and the wider mosaic of wetland habitats in which it is found.

Grazing at appropriate levels can be beneficial in helping to maintain species-richness and in preventing succession. However, over-grazing and excessive poaching is detrimental which can result in disturbed bare ground or nutrient enrichment. This is where a substrate of bare humus, bare peat, bare mineral soil, bare gravel, or soil covered only by an algal mat, has its surface broken and imprinted by hoof marks, wallows, human foot prints, or vehicle and machinery tracks. The emphasis is on 'disturbed' rather than 'bare'.

Heavy trampling and tracking by livestock or ATVs can result in active drainage of the

habitat. Drainage should be considered active if it has altered, or is likely to alter, or remove, the original vegetation, and facilitate the removal of water from the site.

2c. Maintain the distribution and viability of typical species of very wet mires often identified by an unstable 'quaking' surface

This habitat is found in transition with open water and other fen habitats and the typical species are dependent on the site and location of the habitat.

This site is composed of a series of basin mires within an area of undulating heather dominated moorland. The basin mires contain a series of wetland vegetation types typical of nutrient poor, intermediate fen and flush vegetation (spring and surface water fed wetlands).

The basin mires are generally similar being composed of semi-floating sedge mats with occasional small areas of open water. Mosaics of S27 *Carex rostrata – Potentilla palustris* tall-herb fen and M9 *Carex rostrata – Calliergonella cuspidata*/*Calliergon giganteum* mire national vegetation classification (NVC) types form much of the basin mires. The two basins support the populations of slender green feather moss and the wetlands are the locus for many of the more uncommon species. Bottle sedge *Carex rostrata* is often dominant and bog bean *Menyanthes trifoliata* is abundant in both NVC types. Some areas are dominated by lesser tussock sedge *Carex diandra*, with abundant common sedge *Carex nigra* and marsh horsetail *Equisetum palustre.* Some areas are dominated by *Juncus effusus*. In places small *Sphagnum* lawns with *Carex curta* exist indicating a transition to more ombrotrophic conditions. Brown mosses such as pointed spear-moss *Calliergonella cuspidata*, along with common cotton grass *Eriophorm angustifolium*, cuckoo flower Cardamine pratensis, marsh willowherb *Epilobium palustre,* marsh marigold *Caltha palustris* pick out areas of NVC M9. The wetlands are botanically rich with locally uncommon species such as broadleaved cotton grass *Eriophorum latifolium,* dioecious sedge *Carex dioica.* narrow buckler fern *Dryopteris carthusiana*. Other species include Marsh Cinquefoil *Potentilla palustris,* Grass of Parnassus *Parnassia palustris,* few-flowered spike rush *Eleocharis quinqueflora,* brown sedge *Carex disticha* have also been recorded. Other bryophytes include giant spear-moss *Calliergon giganteum*, yellow starry feather-moss *Campylium stellatum*, thick-nerved apple-moss *Philonotis calcarea* and felted thyme-moss *Rhizomnium pseudopunctatum*.

Compared to the baseline the site condition monitoring in 2014 appeared to show the conversion of some S27 in the largest basin to less botanically rich S10 *Equisetum fluviatile* swamp.

S9a *Carex rostrata* swamp forms a margin around the Pitkeathly loch which is artificial and created in the 1977. Plants recorded in the loch include common bladderwort *Utricularia vulgaris*, foru species of pondweed *Potamogeton* spp.and other aquatic plants such as stonewort *Nitella flexilis* var. flexilis. Three other basin mires contain the community and in addition to dominant bottle sedge other sedges can be locally abundant including the locally uncommon mud sedge *Carex limosa* and common sedge *Carex nigra*.

The smallest basin contains M5 *Carex rostrata-Sphagnum squarrosum* mire although lacking the latter species it contains the bog mosses flat-topped bog moss *Sphagnum fallax*, blunt-leaved bog moss *S. palustre* and lustrous bog moss *S subnitens*, bog bead-moss *Aulacomnium palustre,* bottle sedge *Carex rostrata.*

Other wetlands on the site exist between the knolls of dry heath H12 *Calluna vulgaris – Vaccinium myrtillus* heath. These wetlands are mainly soligenous flushes of acid (M6 *Carex echinata - Sphagnum fallax/denticulatum* mire) and base rich types (*M10 Carex dioica – Pinguicula vulgaris* mire*)* which are botanically rich. Additional species include flea sedge *Carex pulicaris* common yellow sedge *Carex demissa,* carnation sedge *Carex panicea,*

Equisetum palustre, star sedge *Carex echinata*, devilsbit scabious *Succisa pratensis,* lesser spearwort *Ranunculus flammula,* bulbous rush *Juncus bulbosus,* rusty hook-moss *Scorpidium revolvens,* tormentil *Potentilla erecta,* marsh lousewort *Pedicularis palustris.* Small areas of NVC M6 fringed some basin mires having dominant *Juncus acutiflorus*, growing in a matrix of bog mosses *Sphagnum spp.* M23 *Juncus effusus/acutiflorus – Gallium palustre* rush pasture covers the peripheral areas of the mire basins and land between the heather covered knolls and in the drainage gullies. Sharp-flowered rush *Juncus acutiflorus* is dominant with a range of herbs. The locally uncommon knotted pearlwort *Sagina nodosa* a plant of mires and springs irrigated with base-rich water has also been recorded.

The rare hairy stonecrop *Sedum villosum* has previously been recorded in one area of M10 mire on the site but appears to have disappeared as the vegetation here is now very coarse due to the lack of grazing which appears to favour the plant.

The grazing regime may need to be carefully reviewed in the future in order to maintain the typical species of this habitat.

In addition to Slender green feather moss, the site is important for a range of other bryophytes including two rarer species. Woolly feather-moss *Tomentypnum nitens* a scare and declining species of calcareous fens rich in sedges. Bog pawort *Barbilophozia kunzeana* a liverwort is found on boggy ground, in moist soil or peat, on flushed rocks shaded by heather in montane habitats descending to 150m rare.

The two populations of slender green feather moss at Pitkeathly Mires SAC are part of a wider metapopulation which exist on surrounding land outside the designated site to the south east on Rossie Ochil and the Lochelbank wind farm site. They are found in the same rich fen habitat of M9, S27 and S9 but are hydrologically separated from the populations on the SAC.

Apart from plants common blue damselfly *Enallagma cyathigerum* has been seen on the site. Breeding tufted duck and dabchick have been recorded along with a range of other wildfowl such as teal, wigeon and mallard. Buzzards, snipe and peregrine falcon have all been recorded in the area.

Conservation objectives for slender green feather-moss *(Drepanocladus) (Hamatocaulis) vernicosus)*

1. To ensure that the qualifying feature of Pitkeathly Mires SAC is in favourable condition and make an appropriate contribution to achieving favourable conservation status.

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When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, band c). If broader information on the feature is available then

it should be used to provide context to the site-based appraisal.

Note that “appropriate” within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of Pitkeathly Mires SAC is maintained by meeting objectives 2a, 2b and 2c for the qualifying feature.

The aim at this SAC is to maintain the qualifying species in a favourable condition as a contribution to its wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on maintaining site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will continue to be maintained. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the maintenance of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover.

This objective recognises that the qualifying species is exposed to a wide range of drivers of change. Some of these are natural (e.g. population fluctuations/ shifts or habitat changes resulting from natural processes) and are not a direct result of human influences. Such changes in the qualifying species’ distribution and use of the site, which are brought about by natural processes, directly or indirectly, are normally considered compatible with the site’s conservation objectives. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

2a. Maintain the population of slender green feather-moss as a viable component of the site

The conditions for the long-term existence of slender green feather-moss at Pitkeathly Mires SAC should be maintained.

During the 2008 SCM visit slender green feather-moss was found in two areas within the site, both of which were found to be supporting many thousands of healthy-looking shoots.

The key factor likely to affect the population of the species are changes in hydrology, however this is not thought to be likely other than through potential drying due to nearby afforestation.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective, for example, changes in drainage, afforestation or increased nutrient input from industry, transport or agriculture. The appraisal should also consider the life cycle and life history of the species and the scale and duration of the impact being assessed.

The rate of recovery of this species is not fully understood. However, observable increases in large colony size have been detected over a four year period at Whitlaw and Branxholme SAC, and studies elsewhere have shown that it has a good capacity to recover when conditions are suitable.

2b. Maintain the distribution of slender green feather-moss throughout the site

Conditions within the site should allow for the distribution of slender green feather-moss to be maintained.

Slender green feather-moss only rarely produces reproductive capsules. It is a turf-forming species composed primarily of non-creeping packed vertical stems with limited branching. Opportunity for dispersal between sites is therefore limited.

Slender green feather-moss occurs in two areas in the eastern half of Pitkeathly Mires SAC.

Land management changes in the form of new woodland creation with conifers within the catchment can affect the hydrology and water quality of this site if not planned carefully.

2c. Maintain the habitats supporting the slender green feather-moss within the site and availability of food

The distribution and extent of slender green feather-moss habitat within the site should be maintained, together with the structure, function and supporting processes of the habitat.

Slender green feather-moss is characteristic of mires which are mineral rich but not strongly calcareous. At one extreme, it has been collected from a *Ranunculus omiophyllus-Montia fontana* flush, indicating a relatively poor substrate. At the other, its habitat overlaps with that of the basiphile moss *Scorpidium cossonii*. Although the two species are not often found growing together, very occasionally they occur intermixed or in close proximity.

At Pitkeathly Mires SAC the slender green feather-moss occurs in mire with e.g. water horsetail, marsh horsetail, cuckoo-flower, rough meadow-grass, sharp-flowered rush, lesser spearwort, northern marsh orchid, ragged robin, sedges, marsh pennywort, marsh bedstraw, Yorkshire fog, marsh marigold and water mint. The bryophyte flora is rather poor, with *Brachythecium rivulare*, *Calliergonella cuspidata*, *Climacium dendroides*, *Drepanocladus cossonii*, *D. revolvens* and *Plagiomnium undulatum*. These species could be used to indicate continued good habitat, however, direct monitoring of slender green feather-moss must also be carried out periodically.

The water table/hydrology and potential nutrient inputs should be investigated if there are detectable declines in the extent of slender green feather-moss.

At some point in the past there appears to have been an episode of nutrient enrichment which has led to subtle vegetation changes in the largest basin within the SAC. This basin contains one of the two populations of slender feather moss on the site. No ongoing management issues have been identified as causing this change so no management recommendations have been made. However, any future changes to grazing management will need to be carefully considered to ensure nutrient enrichment is avoided.

Conservation Measures

Pitkeathly Mires is notified as a Site of Special Scientific Interest and management changes described on the SSSI list of Operations Requiring Consent must have prior consent from SNH (NatureScot).

Current and recommended management for slender green feather-moss and very wet mires often identified by an unstable 'quaking' surface

Issue	Measure	Responsible party
Grazing	Livestock grazing by cattle and possibly the occasional sheep takes place on two ownerships. The main part of the SAC forms part of a larger management parcel which extends further east toward Lochelbank windfarm.	Land managers, NatureScot, Deer Management Groups
	Two management agreements cover all the land within the SAC between NatureScot and the landowners. Both agreements run for 999 years from 1987 and 1988. The grazing regime may need to be reviewed in the future in order to maintain the typical species of the very wet mires often identified by an unstable 'quaking' surface habitat.	Land managers, NatureScot, Deer Management Groups
	Avoid supplementary feeding of livestock close to Pitkeathly loch as this could concentrate livestock close to the water leading to excess nutrient or sediment entering the loch from poaching, heavy dunging or uneaten fodder.	Land managers, NatureScot, Deer Management Groups
	Ensure that livestock impacts on the feature are 'low' based on the FCS/NatureScot Herbivore Impact Assessment Process to prevent poaching and/or loss of typical species.	Land managers, NatureScot, Deer Management Groups
Heavy trampling and/or tracking	Trampling and/or tracking by livestock / ATV's to be minimal to be prevent active drainage of this habitat. Vehicle use to be restricted to existing tracks and vehicles to avoid travelling through the basin fens.	Land managers, NatureScot, SSEN, Deer Management Groups
Colonisation by vigorous native and/or non-native species	Ensure colonisation of this habitat by vigorous native species, such as reed canary grass, rushes, grasses, water horsetail, tree or scrub growth or invasive non-native species is minimal to prevent loss of indicator species and conversion to other open ground habitats or woodland.	Land managers, NatureScot

	All anglers and other water users (such as canoeists, wild swimmers or researchers) should follow the Check, Clean, Dry biosecurity procedures to help prevent the spread of problem non-native species.	All
Water management	Maintain current hydrological regime or improve where man-made constraints exist.	SEPA, NatureScot, Land manager
Development	Ensure any development proposals do not adversely affect the site and should include appropriate measures to minimise sediment run-off and prevent pollutants from entering the SAC.	Land Managers The NatureScot, Local Planning Authoity
Forestry operations	Forestry management of land to the north should be carried out such that it does not impact on the SAC. Continue to monitor and take action as necessary to ensure there are no adverse impacts from future or current woodland creation proposals on surrounding land. For example mechanical ploughing or scarification for tree planting in the catchment of the mires. Maturing forestry to the north and new woodland creation immediately to the west is a potential seed source for non-native conifer species especially with very low grazing pressures.	NatureScot, Scottish Forestry, land managers
	Ensure that any forestry is not beyond the carrying capacity of the catchment and that design and management strictly follow the guidelines.	Land Managers
	Promote adherence to the Forest and Water Guidelines, and published best practice, during forest restructuring and highlight the need to strictly control fine sediment and other diffuse pollution release into the loch.	Scottish Forestry, Forestry & Land Scotland, Forestry owners and managers
Water quality	Implement and maintain monitoring of key water quality parameters.	NatureScot/SEPA
	Tackle water quality issues if they should arise, especially eutrophication.	SEPA
	Maintain water quality within the catchment of the basin mires by avoiding land use changes or land management changes which would cause pollution or changes in water chemistry.	Land managers, NatureScot
Electricity Wayleave	Ensure maintenance or refurbishment of high voltage electricity wayleave is carefully planned and executed to ensure no damage to basin mires.	NatureScot, SSEN
Monitoring – slender green feather-moss	Continued monitoring of distribution of Slender green feather moss across the SAC.	NatureScot

Research – Slender green feather moss	Translocation within site to areas where species has been lost, or were not found but conditions suitable. As part of the Lochelbank wind farm development, habitat management was carried out to translocate a population of slender green feather moss within the wind farm with subsequent habitat monitoring not far to the south east of the SAC.	NatureScot, Operators of Lochelbank Wind Farm
	Conduct a baseline hydrological survey to better understand the conditions that support the moss at its SAC sites and enable changes in hydrology to be interpreted.	NatureScot

Contact details:

NatureScot
Battleby House
Redgorton
Perth
PH1 3EW
Tel: 01738 444 177

Approved on 31 March 2020 by:

Greg Mudge	**Denise Reed**
Principle Advisor	Area Manager
International Designations	Tayside & Grampian